

SCIENCE

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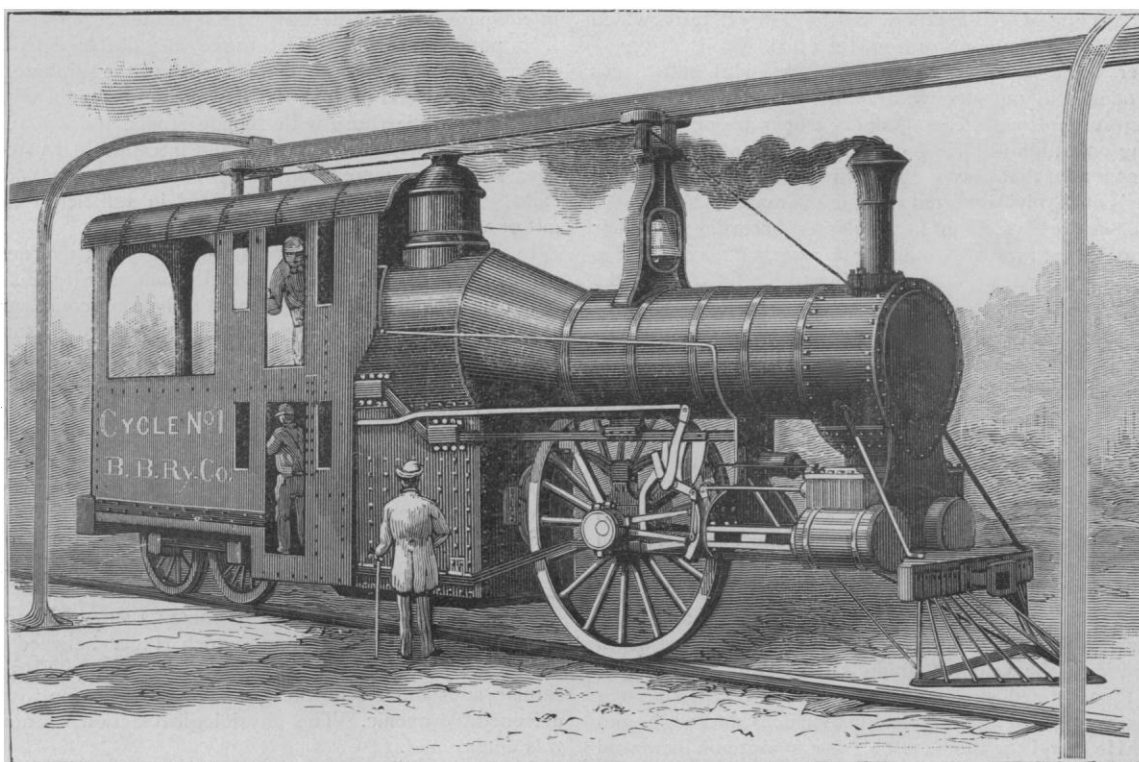
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THE BOYNTON BICYCLE RAILROAD.

A TRIAL trip of the Boynton bicycle locomotive and cars was made on the company's experimental track, between Bay Ridge and Coney Island, on Monday last. A portion of the old Sea Beach Railroad track was remodelled for the purpose by the erection of uprights supporting the guard-rail shown above the loco-

reached, however, as near as could be computed on a short track, was at the rate of twenty miles an hour. The road had a rise of 98 feet in 4,300 feet of length, and was nearly all curves, and consequently was well adapted for testing every point of the new system except speed. The motion of the train was remarkably smooth, and free from jolts.

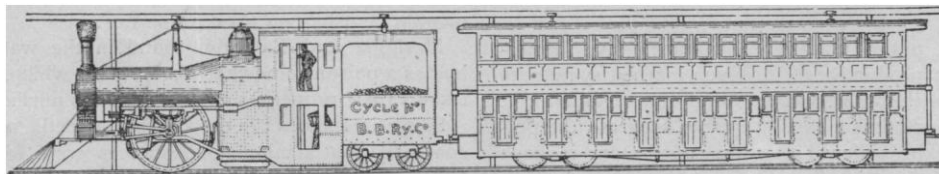


BOYNTON BICYCLE LOCOMOTIVE.

tive in the illustrations. By the placing of a guard-rail of this kind above each rail, an ordinary single-track road may be converted into a double-track road for the Boynton system, the locomotives and cars being so narrow that trains will pass each other under such circumstances without danger of coming into contact.

On Monday's trial-trip the train consisted of Cycle Engine No. 1,

The locomotive weighs twenty two tons, and its total height is 15 feet 6 inches. It has a single driving-wheel of 7 feet 9 inches diameter, with double flanges, to ride on a single rail. The cab is two stories high, the upper story being occupied by the engineer, and the lower by the fireman. The engine has two cylinders, 12 by 14 inches each, and is operated with a boiler-pressure of 150



BICYCLE LOCOMOTIVE AND PASSENGER-CAR.

and one car of eighteen compartments. The car was fitted to seat one hundred and eight persons, and that number made two trips over the road to Coney Island, and back to Gravesend. It is claimed by the inventor, the Hon. M. E. Boynton, that a speed of one hundred miles an hour can be obtained with this system, although no effort was made to run at a high rate of speed on this occasion, owing to the bad condition of the road-bed. The speed

pounds to the square inch. The passenger-cars are 4 feet wide, 14 feet high, in two stories, 40 feet long, and are designed to weigh five tons each.

Future developments of this system, as to speed, economy of construction, operation, and maintenance, and general adaptability to regular passenger and freight traffic, will be awaited with interest by all concerned in railroad operations.

THE RÔLE OF PTOMAINES IN INFECTIOUS DISEASES.

THE trustees of the Fiske Fund, — Albert Potter, M.D., Chepachet; John W. Mitchell, M.D., Providence; William H. Palmer, M.D., Providence, — with George L. Collins, M.D., Providence, as secretary, at the annual meeting of the Rhode Island Medical Society, held June 13, 1889, announced that they had awarded a premium of two hundred and fifty dollars for the best essay on "The Rôle of Ptomaines in Infectious Diseases," to an essay bearing the motto, "Their poison is like the poison of a serpent." The author was found to be Charles V. Chapin, M.D., of Providence, R.I.

From Dr. Chapin's historical sketch we learn that the word "ptomaine" (from *πτῶμα*, "a corpse") was first applied by Selmi to basic substances derived from the putrefaction of organic nitrogenous material. The ptomaines are of the same general chemical composition as the vegetable alkaloids of pharmacy, and they are not to be distinguished from them by chemical tests. Individual alkaloids can, of course, be distinguished one from another, but there is no sharp line of demarcation, and no general tests, which seem to distinguish the ptomaines from the alkaloids.

The former term is applied to those alkaloidal substances which are produced by putrefactive decomposition; that is, by the action of micro-organisms. The alkaloids proper are produced by changes going on within the living organism of plants. But they have this in common, that they are both produced by a retrograde metamorphosis of highly organized albuminoid material.

The ptomaines are divided into two classes, according to their chemical composition; the first containing no oxygen and volatile, the second containing oxygen and corresponding to the fixed alkaloids. The internal chemical composition, and the methods by which they are isolated, belong rather to the domain of chemistry than pathology. It is sufficient to say that they are separated from their aqueous extracts by means of ether, chloroform, benzene, or other non-miscible solvents, which are then evaporated, the residue extracted, and the process repeated, and finally the different ptomaines separated and isolated by precipitation with various re-agents suitable for the purpose.

A history of the various experiments and observations which gradually led up to a correct understanding of the chemistry and pathology of these compounds is most important in this connection.

Haller, in the middle of the last century, was the first to experiment in regard to the nature of putrefactive poisons, determining that the aqueous solutions of putrid substances would cause death when injected into the veins of animals. Gaspard, in an article published in 1822, related similar experiments, and noted among the symptoms, vomiting, twitching and convulsions, hiccough, and great thirst. He found the intensity of these symptoms increased with the amount of the dose: in the majority of cases, death occurred within twenty-four hours. He determined by experiment that neither CO_2 , nor H_2S , nor NH_3 could produce such symptoms, but believed that it must be some other chemical substance. Gaspard showed that the blood from an animal thus infected could infect another, and he referred to the similarity of the nature of this infection to that of the specific infectious fevers. Somewhat similar results, which he obtained by the intra-venous injection of pus, he attributed to the products of septic processes, which had begun in the pus.

Magendie found that putrid materials introduced into the alimentary canal were not productive of any such marked symptoms as when introduced into the veins, and he therefore concluded that the mucous membrane acted as a sort of filter to separate the poisonous elements; and he believed that the respiratory mucous membrane had the same function, for he exposed pigs, fowls, rabbits, and dogs to putrid exhalations, and only the latter succumbed, and they only gradually, giving no evidences of acute poisoning.

Leuret repeated the injection experiments of Gaspard and Magendie, and accepted their views of the chemical nature of the septic poison; but he did not succeed in isolating it, or determining its nature.

Virchow also showed that septic infection quickly caused vomiting, diarrhoea, muscular weakness, and convulsive symptoms, with

great heart weakness, and death in a few hours. Beck repeated these experiments, and determined the presence of sulphide of ammonia in the putrid material, and showed that it would also produce a fatal result.

Stich performed similar experiments, and came to the same conclusions as to the chemical nature of the poison. Then followed the experiments of Panum in 1850. He was the first to actually determine the chemical nature of the septic poison by separating it from septic solutions.

Weber v. Hemmer repeated Panum's experiments with substantially the same results, and Thiersch, Stich, and Schwenninger followed in the same path; but none of their work was as thorough and satisfactory as Panum's.

In 1866 Bence Jones and Dupré separated from the decomposing organs of men and animals, especially from the liver, an amorphous substance to which they gave the name "animal chinoidin," from its presenting a fluorescence like quinia when dissolved in dilute sulphuric acid.

In 1868 Bergmann succeeded in isolating a putrid poison, and, in company with Schmedeberg, he separated a poisonous substance from putrid yeast. This substance they obtained by a circuitous process, in the shape of minute crystals of the sulphate. Its watery solution produced in dogs the symptoms of septic poisoning, such as vomiting, diarrhoea with bloody stools, and, on autopsy, there was ecchymosis of the stomach and intestines. In frogs, also, severe symptoms were produced. This poisonous substance was called "sepsin," but was not obtained in sufficient quantity to admit of a determination of its chemical structure.

In 1869 Zuelzer and Sonnenschein separated from macerated bodies a crystalline substance which exhibited all the alkaloidal reactions. Physiologically it seemed to be a narcotic, somewhat like atropine, and resembled the so-called "sausage poison." It produced dilatation of the pupil, muscular paralysis, and acceleration of the cardiac pulsations. The authors obtained this substance by the ether and alcohol process for separating alkaloids, called Otto-Stas's method, and also by diffusion and extraction with glycerine.

Rörsch and Fassbender obtained from a cadaver a non-crystallizable substance resembling digitaline in its properties, but not having its bitter taste.

Schwanert, at about the same time, obtained from a dead body an oil with strong basic properties, and which smelled like propylamine.

Marquardt, and later Hager, obtained a substance to which was given the name "septicin," and which Hager believed was a mixture of amylamine and caprylamine. Lieberman also obtained a similar substance from the stomach of a person who had been poisoned by arsenic. The physiological action of none of these was determined.

Krebs-Brandes obtained a coniine-like substance, and found that .007 of a gram injected into a frog killed it instantly, and .044 of a gram had the same effect on a pigeon in a few minutes.

Brouardel and Boutmy found in a decomposed goose a substance which gave re-actions, like coniine, and which produced toxic symptoms.

According to Husemann, there are a large number of cadaveric alkaloids which resemble coniine.

Wolkenhaar separated an amorphous base, which resembled nicotine, but had no toxic properties.

Moriggia and Battistini found in the watery extract of dead bodies a poison somewhat like curara; which, however, gradually lost its toxic properties the more it was purified.

Selmi, in Italy, while engaged as a medico-legal expert, became convinced that alkaloidal substances were formed in the human body after death by the putrefactive processes there taking place. From 1870 till the day of his death, Selmi devoted himself to the study of these substances; and he determined the occurrence of several alkaloids similar to morphine, coniine, atropine, and delphine, and other vegetable alkaloids, but he did not succeed in separating any of them with sufficient purity to permit of chemical determination. Selmi, however, did much to encourage and advance the study of these substances, and definitely determined that they were produced by the action of microbes on proteid tissue. Among the other Italians who were encouraged to pursue this line

of study by Selmi's work may be mentioned Brugnatelli, Zenoni, and Cortez, who found an alkaloid resembling strychnine in decaying corn-meal. At the same time, Gautier, in France, was attacking the problem, and independently arrived at the same results, — that alkaloids are produced by the decomposition of albuminous substances.

The first to actually separate and determine the chemical composition of an animal alkaloid was Nencki, in 1876. He obtained from decomposing gelatine needle-shaped crystals of a salt to which he gave the name "collidin," and which he determined had the formula $C_8H_{11}N$.

During the last five or six years the study of ptomaines has received much attention on both sides of the Atlantic; but no one has done so much to develop methods of procedure, and put our chemical knowledge of these substances on a firm scientific basis, as Brieger. Of the ptomaines whose composition has been determined, Brieger analyzed nineteen, while Gautier and Etard come next with three.

The infectious diseases, at least those which are caused by micro-organisms (and those are the only ones we are now considering), may be classed in two divisions.

First, we have those in which the organism invades the blood and propagates there, and by so doing produces profound alterations in that medium. Among such diseases may be mentioned anthrax, malaria, relapsing fever, and certain forms of septicæmia.

The second class includes those diseases in which the micro-organism does not develop in the blood, but only reproduces itself in limited foci. Thus in typhoid-fever the specific organism grows only in glandular structures in the walls of the intestines, and in the mesenteric glands and the spleen; in cholera the growth is confined chiefly to the lumen of the intestines, though the walls of the gut are sometimes invaded; in abscesses and suppurating wounds the pus-forming organisms are confined to the abscess, or the tissues of the wound, and are not found in the blood; and in sapræmia the organisms of putrefaction in most cases do not involve the living tissue at all, but find their pabulum in blood-clots, exudations, and spots of necrosis.

It has been an interesting and important problem to discover how micro-organisms actually produce the symptoms in these different affections. It has been variously attributed to the "mechanical irritation" of the microbes, to their occlusion of minute vessels, to their consumption of certain elements in the blood or tissues necessary to the physiological integrity of the host, and, lastly, to the production of poisonous materials which re-act upon the tissues.

While there are some theoretical and experimental reasons for believing that micro-organisms may occasionally act in all of these ways, the evidence has of late been accumulating, as Dr. Chapin has attempted to show, that the last-named method is by far the most common and important. Even if there were no experimental evidence, we should hardly be able to explain the constitutional symptoms of the second class of infectious diseases in which the organisms are strictly localized, except on the hypothesis of the production of soluble substances which are taken up in the circulation.

But we know that there is much besides mere hypothesis which would lead us to attach great importance to the rôle of the chemical products of bacterial life in the production of the symptoms of the infectious diseases. In certain forms of septic disease the demonstration is complete that the entire circle of symptoms is immediately caused by the action of such substances. The experiments of Bergmann, Hemmer, Weber, and, first and most important of all, Panum, show that chemical substances, which can be isolated, produce precisely the same set of symptoms that are caused by the injection of untreated putrid material containing living organisms; and recently, since the perfection of bacteriological methods, Roux, Chamberland, and Arloing have shown that cultures of septic organisms produce substantially the same results, whether the organisms are present or have been removed by heating or filtration. And not only this, but Roux and Chamberland have obtained the same substances from the tissues of animals suffering with the diseases concerning which the experiments were made.

In the formation of pus it has been demonstrated, that, in some cases at least, it is the ptomaine produced by the organism which induces the migration of the leucocytes.

It is in regard to tetanus, however, that we have the most accurate knowledge in regard to the mechanism of the production of the symptoms. That this disease is caused by a bacillus, which develops in wounds, and does not migrate into the blood-vessels, is beyond question. From artificial cultures of this organism, and also from the tissues of a human subject suffering from the disease, a ptomaine has been obtained which produces in animals the identical symptoms of the disease; and, furthermore, it has been obtained in such purity that its chemical formula has been accurately determined.

Typhoid-fever and cholera do not normally occur in the lower animals, though the administration of their specific organisms under certain conditions is followed by a set of symptoms called "experimental typhoid-fever," and "experimental cholera." The experiments of Sirotinin, and Beumer and Peiper, for typhoid-fever, and of Gamaleïa and Löwenthal for cholera, have shown that all the essential features of these diseases are dependent upon the soluble substances contained in cultures of the organisms.

The experiments that have been made with anthrax, hog-cholera, fowl-cholera, and erysipelas, while indicating to some degree the importance of the rôle played by soluble substances in these diseases, have not given very complete or satisfactory results.

As the subject of the essay is "The Rôle of Ptomaines in Infectious Diseases," the action of other substances has only been briefly alluded to; but it must be remembered that a very large number of substances besides those belonging to this particular chemical group are elaborated by the growth of micro-organisms. We have every reason to believe that the most important are, indeed, of an alkaloidal nature: for the sepsin of Panum, and the tetanine of Brieger, produce all the symptoms of septic poisoning and of tetanus; and cadaverine is, in and of itself, capable of producing true suppuration.

Nevertheless it is probable that such substances as sulphuretted hydrogen, ammoniac sulphide, phenol, etc., all elaborated by bacterial life, have some influence upon the body. Moreover, the experiments of De Christmas, Arloing, Rietsch, and Wooldridge, afford very strong evidence that ferments of a proteid nature play a very important part in the production of infectious diseases. The ptomaines, like the vegetable alkaloids and the leucomaines, all chemical allies, have a markedly selective action on the nervous system; and we may assume with a fair degree of probability that many of the nervous phenomena, the delirium, stupor, tremblings, and paralysis of the infectious diseases are due to these substances. The action of typhotoxine, found in the cultures of the typhoid bacillus by Brieger, and the ptomaine isolated by Hoffa from anthrax cultures, are indications of this.

One of the most common and important phenomena of the infectious diseases is fever. That fever may be produced by ptomaines is shown by Panum's experiments with sepsin, and Hoffa's with the anthrax ptomaine.

That the fever of the infectious diseases is frequently due to these substances is very probable; but that it may be due to other materials or causes is also probable, and, in fact, quite certain. Angerer and Edelberg have shown that fever can be caused by the injection of blood and of fibrine ferment; and Schmiedeberg obtained like results with another proteid substance.

Wood, Reichert, and Hare, Otto, Bergmann, and others have shown that pepsin, trypsin, and pancreatin are all capable of producing a rise in temperature; so that it is highly probable that proteid substances, as well as those of an alkaloidal nature, have much to do with the production of febrile symptoms in the infectious fevers.

The experiments of Arloing and De Christmas would also show that some pyretic substances are not readily diffusible, and are probably of the nature of ferments.

Another rôle of the ptomaines and other soluble substances is the preparation of tissues and fluids for the growth of microbes. There is in the living body a constant tendency towards the destruction of all micro-organisms. This tendency varies greatly from time to time, and can doubtless be greatly affected by the ac-

tion of ptomaines. Thus, in the case of the pus-forming organisms, it has been shown that they can much more readily attack the living tissues when the latter are inflamed; and it has also been shown that the ptomaines, some of them at least, do thus prepare the tissues for the microbes by exciting inflammation. In a broad area of suppuration the ptomaines diffuse into the tissues out beyond the sphere of direct bacterial action, and the organisms follow closely in the wake of the inflammatory area thus formed. This was observed to be the course of events, in the keratitis excited by Leber with cadaverine.

Typhoid, cholera, and many other organisms, are destroyed when injected directly into the blood; but in later stages of these, as of most infectious diseases, the organisms are found often in large numbers in the circulating fluid. It is very possible that the changes in the blood which permit of the growth of the organisms are due in part to the action of ptomaines on the blood itself; but it is also probable that they are due to changes in general nutrition, affecting the organs by means of which the blood is formed. This, however, is a branch of the subject on which we have only just begun to speculate, and on which little work has been done.

On the other hand, we have considerable positive knowledge in regard to an opposite action of ptomaines; namely, the rendering of tissues refractory to the action of microbes. It has long been known that the growth of micro-organisms in artificial culture-media, in very many instances, soon produces such changes that the media are no longer capable of supporting bacterial life. Various explanations have been offered of this phenomenon; but it is now definitely settled, particularly by the experiments of Garré and Freudenreich, that it is in most instances due to the production of substances which exert a hostile influence upon the vegetation of the organisms. This explanation is of very great importance, both practical and theoretical, in relation to immunity, particularly acquired immunity, in animals. Various theories have from time to time been advanced to account for this phenomenon.

1. The theory was advanced by Pasteur and Klebs that the immunity was due to the consumption by the organisms of certain ingredients of the tissues which were necessary for the growth of the organisms, and which were not afterwards replaced. This "exhaustion hypothesis" has now been generally abandoned as not in accord with observed facts.

2. The theory of Metchnikoff is, that the invading organisms are devoured by the leucocytes, which, by this exercise of their functions, acquire an increased power in this direction which can be effectually exercised on a subsequent occasion.

3. Lastly, it has been suspected, that, during the first attack of an infectious disease, soluble substances are elaborated which exert such a physiological action on the tissues that the latter are enabled to resist the invasions of the organisms; and that this refractory condition remains a longer or shorter time, until it is lost through the regular metabolic changes of the animal body. This is the "retention hypothesis," and is favored by most of the evidence which has been accumulating during the last few years.

The immunity which is thus produced has varying degrees of permanency. In malarial and relapsing fevers where there is a distinct remission, it is probable that the organisms produce a substance which is a poison to themselves as well as their host, and that its presence in the blood destroys or drives out the organisms in that fluid, while those that are in the spleen and other lymphatic glands remain unaffected. This constitutes the remission, which only lasts a short time, until the objectionable substances disappear or until the corpuscular elements which have been made refractory have been replaced by others newly formed. In such instances the refractory condition is very brief. In other cases, as in anthrax, studied by Roux and Chamberland, or the experimental cholera of Löwenthal, the immunity may last a few days or weeks. In still other cases it may continue indefinitely, as in measles and small-pox.

The success of so many experimenters in obtaining immunity in animals by the administration of chemical substances opens up the most hopeful field of therapeutic research.

Much was expected from prophylactic inoculations with attenuated but living virus; but the difficulty of keeping the virus of the proper degree of virulence, and the danger that arises from the fact

that every inoculation establishes a focus from which the disease may spread in severe form, have prevented these expectations from being fully realized. But if immunity can be secured by the use of chemical substances, the action of which can be measured and regulated, and which can be prepared outside of the body, we shall obtain an invaluable means of controlling the infectious diseases.

Every experiment which throws any light on this important subject is worthy of close attention, and, if verified, is a step towards the solution of the great problem of the prevention of disease.

RUSSIAN LITERATURE.

IN *The Publishers' Weekly* for Oct. 12 is printed a statistical report, compiled from official sources, of the number of books published and printed in the Russian Empire (excepting Finland) during 1888. The number of titles recorded amounted to 7,427; the total number of copies printed, 21,103,272. Of these, 5,318 books were in the Russian language, 716 in Polish, 343 in Hebrew, 311 in German, 217 in Lettic, and 178 in Esthonian. The following is a classified list, in tabulated form, showing the number of titles and the editions printed of books in the Russian language:—

	Works.	Copies printed.
Works of reference.....	629	3,877,092
Educational:		
Religious.....	521	3,691,838
General.....	720	3,334,182
General.....	848	1,953,818
Medical.....	445	446,985
History.....	256	288,023
Jurisprudence.....	176	248,206
Agriculture.....	173	214,819
Military science.....	159	211,944
Literature.....	155	178,623
Juveniles.....	150	545,662
Geography and travels.....	144	141,062
Popular literature.....	142	821,800
Political economy.....	115	65,341
Technology.....	101	84,088
Natural history.....	93	109,240
Pedagogics.....	60	64,818
Art.....	52	43,417
Philosophy.....	46	62,960
Mathematics.....	45	32,150
Mathematics.....	43	34,417
Politics, etc.....	33	31,070
Miscellaneous.....	312	913,495
	5,318	17,395,050

Among the books of reference there are catalogued 155 Russian almanacs, of which 1,537,649 copies were printed. Besides these, there were also 205 almanacs in other than the Russian language. St. Petersburg and Moscow, of course, lead in the production of literature. Then follow Warsaw, Odessa, Riga, Kasan, Kiew, Tiflis, Wilna, Dorpat, Charkow, Reval, Mitau, etc. The total number of periodicals was 667, of which 493 were printed in the Russian language, 76 in Polish, 49 in German, 13 in Esthonian, 8 in Lettic, 7 in French, etc. The most of these are printed in St. Petersburg. The statistics showing the proportion of inhabitants to the daily journals issued are most remarkable. It appears, that, taking European and Asiatic Russia together, there is but one journal to 484,590 inhabitants. The proportions taken in the cities, for instance, show, in Reval, one daily journal to 8,550 inhabitants; in Riga, one to 13,490; in Tiflis, one to 14,860; in St. Petersburg, one to 28,970; and in Moscow, one to 75,350. This gives one a tolerably clear idea of the intellectual development of the masses.

M. Pawlenkow gives the following facts concerning the prices some of the prominent Russian authors realized for their work. Shortly before his death, Turguenieff sold the rights in all his published works, "for all time," to Glasunow, for 90,000 rubles (over \$69,300). The publishing-house of Ssalajewy offered to the novelist Shtshedrin for his writings 60,000 rubles, but the transaction was not consummated. Gogol received 60,000 rubles; Pushkin, 35,000 rubles; Schukowskij, 5,000 rubles; Krylow (for his fables), 14,000 rubles; Nekrassow, 15,000 rubles; Gontsharow, 35,000 rubles; Ostrowskij, 10,000 rubles (for one edition); Grigorowitsh, 5,000 rubles; Aksakow, 3,000 rubles (for one edition); Mey, 1,000 rubles. The popular author, Gleb Uspenskij, sold his works to Pawlenkow and Ssibirjakow for 25,000 rubles. Pawlenkow printed

a cheap edition of these books, and sold 10,000 copies within one year. Popular text-books seem to have the largest sales; and Polubojarinow, the publisher, paid to the author of a series of arithmetics, Mr. Jewtushewskij, the sum of 50,000 rubles. From the foregoing it will appear that the notion that Russian literature is made up solely or largely of those writers whose works have thus far been translated into English — Turguenieff, Tolstoi, Dostoyevsky, and Gogol — is fallacious. As a writer in the *Christian Union* recently pointed out, it would be as just to England and America to translate Dickens, Hawthorne, and Haggard into some foreign tongue, and represent them as English literature, as it is to Russian literature to be judged by the writings of the authors now known to us through English translations. "Nothing could be more unfounded or contrary to the fact than the impression which is abroad that we have in these translations a fair presentment of Russian literature. In reality, we who only read English — and even those of us who know French and German — have gained no more of that literature than the faintest glimpse. With very few exceptions, the books that have been Englished are all novels: they are all novels of the modern period, but they do not do the smallest justice to the novelists of that period. We rave about Turguenieff and Tolstoi, but what of Gontcharov, Pisemsky, and Pomyalovsky, and half a dozen others equally or unequally noteworthy, about whom never a word is said? And then what have the Russian poets, the Russian essayists, the Russian historians, the Russian scientists, done, that we should be kept in the most Cimmerian darkness as to them and their works? By what strange caprice of translator or publisher or public is it that to Anglo-Saxon readers Pushkin, Lérmontov, Griboyédov, Kylov, Bielinsky, Káramsin, Bestyuzhev-Ryúmin, Solóvieff, Písarev, Dobrolyúbov, and so many others, remain practically unknown? All the more is there reason to wonder at and deplore this neglect when it is remembered that in ignoring writers like these we are taking special pains, as it were, to hold unliquidated our manifest duty to a great race."

ELECTRICAL NEWS.

NEW INSULATING MATERIAL. — A recent German patent for a new insulating material for electric conductors specifies the use of paper which has been thoroughly soaked in an ammoniacal copper solution. The pasty mass is then pressed against the conducting wires to be covered by means of rollers, and the whole is finally submitted to strong pressure. When dry, the covered wire is passed through a bath of boiling linseed-oil, being left in it until the covering is saturated. This makes it elastic and impermeable to moisture. The covering is said to be durable, and efficient as a non-conductor.

LEAD-COVERED CABLES. — It has been accepted as an acknowledged fact that lead-covered cables, when placed under ground in creosoted wooden troughs, undergo a rapid deterioration of the lead sheathing, owing to the metal being converted into a carbonate; but closer research tends to show that this destruction need not necessarily take place. Close observation of creosoted conduits and lead-covered cables, laid at various times since 1884, apparently prove, according to the *London Electrical Review*, that the destructive agent usually present in freshly creosoted wood disappears almost entirely after a few years. A cable was laid upwards of two years ago in a conduit constructed in 1884, and at this date there is but very slight trace of action on its surface, while part of the same cable laid in an 1888 conduit shows considerable scale of carbonate of lead after one year's exposure. Parts of the same cable placed in other conduits about a year after their construction show but little damage. One cable laid in 1885 is only slightly affected, and it is not anticipated that any further deterioration will take place. Some experiments to test the effect of time and ventilation on creosoted wood were carried out by placing cables covered with an alloy of tin and lead in boxes made of creosoted wood, one box made of wood creosoted more than two years back, and another more recently impregnated. These boxes were sealed up, and opened after a lapse of three months. The samples in the old wood box were barely touched, while the samples in the newer one were thickly covered on the sides and top

with what is chemically known as phenolate. Either phenol, a volatile gas, or acetic acid in combination with carbonic-acid gas, will attack lead and reduce it to a carbonate. If no acetic acid is present in the wood, and the phenol be evaporated by some means or another, there should be no more damage done to lead cables in creosoted troughs than if they were run in conduits of other materials; but means should be taken to freely ventilate the troughs, not only to protect the cables, but also to guard against accumulations of explosive gas. Under these conditions, plain lead sheathing would prove as efficient as that made of the tin alloy, the durability of which latter covering can hardly be accepted as assured.

LIGHTNING ON WAR-VESSELS. — Apart from the modern vessels being protected by their construction, or by special provisions for the purpose, the *London Electrical Review* asserts that lightning does not play as destructive a part as it did forty or fifty years ago, as even those ships unprovided with conductors have suffered less damage than a smaller number of ships experienced formerly; not that modern vessels are exempt, but they seem to be struck in a manner which causes fewer fatal accidents, and in some cases even the effects of a lightning-flash have borne so little trace of their origin that they have been credited to the wilful act of some one on board.

HEALTH MATTERS.

The Pathological Bearings of Heredity.

ANIMALS, including man, have arrived at their present state of development by the combined but rival forces of heredity and evolution, the latter term including the effects of surrounding environment. Evolution without heredity, as Ribot observes, would render every change transitory; and every modification, whether beneficial or not, would disappear with the individual. The results of heredity without evolution, on the other hand, would give us the monotonous conservation of the same types fixed once and for all. With heredity and evolution we have life and variation. Evolution produces physiological and psychological modifications, habit fixes these in the individual, and heredity fixes them in the race. These aphorisms, says *The Medical Press*, apply as well to diseased conditions as to health, and, in endeavoring to unravel the mysterious bearings of heredity upon disease, we have to bear in mind the conflicting influence of stability with this tendency to variation. The operation of hereditary tendencies is perpetually disturbed by innumerable circumstances unappreciable by our means of observation, but capable nevertheless of producing varieties infinite alike in extent and degree.

It is well known that sensitiveness, whether to general or special impressions, varies extremely in different individuals. An operation which involves pain amounting to agony to one person will be borne by another with comparative indifference; and the tissues of one person will re-act to stimuli to such an extent as to cause violent inflammation, while those of another prove quite passive under similar circumstances. It is this varying irritability which explains the fact that no two cases are exactly alike of the same disease. These differences are distinctly transmissible from parent to offspring; and, when the inherited quality is a tendency on the part of certain tissues to re-act more readily than normal to morbid influences, we say that a person has a diathesis. What we term, for the want of a better word, idiosyncrasy, is in reality a diathesis or part of a diathesis, — a peculiar susceptibility of the individual to re-act unduly, either in excess or otherwise, to certain stimuli. Idiosyncrasies may be transmitted, as they very frequently are; but they are in any case congenital. These peculiarities of tissue and function often remain latent until some morbid process emphasizes the fact that a particular proclivity exists in the individual. This point cannot be better illustrated than by quoting the well-known story, that, of several hunters who were thrown at the same time into the same stream of water, no two were affected alike. In one an attack of rheumatism marks the tendency of joint-tissues to take on a certain process of inflammation, in another an attack of inflammation of the lungs points out the pulmonary apparatus as the organ least endowed with powers of irritability, while a third

simply gets a cold in the head. As for the horses, they very probably escape scot free in the absence of any special or general variation in the tissue tendencies.

While we recognize clearly enough that certain diseases are largely influenced by inherited tendencies, there are others, and these the majority, in which the influence of heredity is more or less indistinct; but it is as certain as any thing of the nature of a deduction can be that the conduct of a particular organism, in the face of morbid influences, is determined largely by inherited qualities of tissue, even when the susceptibility is difficult or impossible to make out. The problem before us is to discover and elucidate the natural laws which govern and regulate the transmission of mental and physical qualities, or, in the words of Mr. Lewis, "the paths along which forces travel to their particular results." We are already in possession of a large number of facts and observations bearing upon the "how," though the "why" still remains, and is likely to remain, unfathomable. These relative individual differences of bone tissue-cell, organ, membrane, and vessels, which are admitted by all competent authorities, really form the foundation of all sound views in pathology; and the more they are recognized and appreciated, the more will the art of medicine acquire scientific exactitude and increased usefulness to humanity. In the words of Sir James Paget, better treatment will follow better diagnosis, and better diagnosis will certainly follow a more exact pathology.

PEA-SOUP AS A SUBSTITUTE FOR BEEF-TEA.—Dr. Ris of Kloten, Switzerland, says *The British Medical Journal* of Sept. 28, emphatically recommends pea-soup as an excellent substitute for beef-tea for invalids, convalescents, and more especially for patients suffering from cancer of the stomach, or *diabetes mellitus*. Take pease, water, and sufficient amount of some vegetables suitable for soup, and one-half per cent of carbonate of soda, and boil the whole until the pease are completely disintegrated; then let the soup stand until sedimentation is complete, and decant the fairly clear, thin fluid above the deposit. The product is stated to resemble a good meat-soup in its taste, to be at least equally digestible, and at the same time to surpass the very best meat-soup in nutritive value. The latter statement may appear surprising, but the author reminds us that pease (as well as beans or lentils, either of which may be used instead of pease) contain a considerable portion of legumen; that is, a vegetable albumen which is easily soluble in a faintly alkaline water, is not coagulated by heat, is easily absorbed, and equal to the albumen of eggs in its nutritiousness.

MALARIAL FEVER IN EASTERN MASSACHUSETTS.—The results of a study on this subject by Charles H. Cook, M.D., of Natick, are, (1) that the disease seems thus far to have been limited to the cities and towns along the Charles and Sudbury Rivers and the branch of the Blackstone; (2) that it seems to have travelled to the east rather than to the west, that is, in the direction of the prevailing winds rather than against them; (3) that it seems to have developed and increased in seasons below the average temperature equally well as in those above; (4) that some of the marked outbreaks occurred in cold and wet periods, as well as in hot and dry seasons; and (5) that an "essential," as given by at least one authority, — namely, that there must be an average temperature of at least 58° F. for twenty-four hours to develop the disease, — does not hold good in this analysis; neither does another "essential" of an average temperature of at least 65° F. for twenty-four hours to produce an epidemic.

TRANSPLANTING OF A CHICKEN'S CORNEA.—Dr. Gravenigo, of the University of Padua, is said to have successfully performed an operation which hitherto has been vainly tried by various experimenters, both in France and elsewhere. The operation consists in the grafting of a chicken's cornea into the human eye. In the successful case reported by Gravenigo the graft is said to have united quickly, and formed a cornea which was very transparent, shining, and convex.

THE SANDWICH ISLAND LEPER COLONY.—The leper colony on the Sandwich Islands contained a hundred persons in 1884. At present the number is smaller, and most of them are men. The government, according to recent reports, contributes one hundred

thousand dollars a year toward the expenses of the colony, and three years ago the king personally inspected it. The average duration of the disease is eleven years, and the mortality fifty-eight per thousand. The local physician, Dr. Hoffman, is a victim of the disease.

THE FOODS OF DIFFERENT PEOPLES.—Many nations, many dishes! Some articles that are esteemed as delicacies by certain nations are regarded with disgust by others. According to the *Pacific Record*, the Turk is seized with violent trembling at the very idea of eating oysters. The American Indians look upon an invasion of grasshoppers as a mark of especial favor from the Great Spirit, and make the best of such a time to lay up a store of provisions for the future. Buckland states that among certain people a mixture of fish nearly putrefied and soapsuds is preferred to the best butter. In Canton and other Chinese cities rats are sold at ten cents a dozen, and a hind-quarter of dog is more expensive than mutton or beef. Some of the East Indians eat serpents dried in the oven, but despise the flesh of rabbits. Lizard-eggs are a delicacy in the islands of the Pacific, and many people besides the aborigines of the Argentine Republic esteem the flesh of the skunk. Ants are eaten by many peoples, and in Siam a curry of ants' eggs often tickles the palates of the wealthy. The silk-worm is eaten with relish by the Chinese, and a dessert of roast snails is considered a fitting termination of a feast in New Caledonia.

THE DREAD OF DEATH.—Sir Lyon Playfair, in a letter to Junius Henri Browne, author of a paper with the above title, says, "Having represented a large constituency (the University of Edinburgh) for seventeen years as a member of Parliament, I naturally came in contact with the most eminent medical men in England. I have put the question to most of them, 'Did you, in your extensive practice, ever know a patient who was afraid to die?' With two exceptions they answered, 'No.' One of these exceptions was Sir Benjamin Brodie, who said he had seen one case. The other was Sir Robert Christian, who had seen one case, that of a girl of bad character who had a sudden accident. I have known three friends who were partially devoured by wild beasts under apparently hopeless circumstances of escape. The first was Livingstone, the Great African traveller, who was knocked on his back by a lion, which began to munch his arm. He assured me that he felt no fear or pain, and that his only feeling was one of intense curiosity as to which part of the body the lion would take next. The next was Rustem Pacha, now Turkish ambassador in London. A bear attacked him, and tore off part of his hand, and part of his arm and shoulder. He also assured me that he had neither pain nor fear, but that he felt excessively angry because the bear grunted with so much satisfaction in munching him. The third case is that of Sir Edward Bradford, an Indian officer now occupying a high position in the Indian office. He was seized in a solitary place by a tiger, which held him firmly behind the shoulders with one paw, and then deliberately devoured the whole of his arm, beginning at the end and ending at the shoulder. He was positive that he had no sensation of fear, and thinks that he felt a little pain when the fangs went through his hand, but is certain that he felt none during the munching of his arm."

CHOLERA IN ASIATIC TURKEY.—Bagdad and Bussorah have been visited by an epidemic of cholera. The disease was first noticed in obscure inland spots, whence it spread to the port of Bussorah, near the head of the Gulf of Persia.

TOBACCO AND INSANITY.—The essay recently read before the San Francisco Medical Society by Dr. Shiels, on tobacco and its effects, was one deserving of exceptional credit, as well for the thoroughness of his investigations as for the general fairness of his conclusions. The doctor addressed a series of questions to the members of a leading New York medical society individually, and upon their answers his deductions are mainly based. The general trend of the decisions of this medical tribunal is that smoking in excess is bad, which few will be found to dispute. The question, "Have you ever seen a case where the brain was permanently affected by the use of tobacco?" elicited a symphonious chorus of noes all along the line, disturbed only by the solitary demurrer of

an ex-asylum superintendent, who claimed five cases of insanity due to the weed. Dr. Shiels believes there must have been some error of diagnosis here, and beyond a doubt the large majority of asylum physicians would, if canvassed, sustain him in his scepticism. It is only in a remote and subsidiary sense that the tobacco habit can be considered a factor in the production of insanity. Its opponents urge that it promotes nervousness. This depends on the individual and the amount indulged in. They also claim that it weakens moral fibre, impairs nutrition, fritters away a man's time, and induces a host of other evils. But it is not upon the brain that the penalties of its immoderate use are visited: the organs more likely to suffer are the heart, stomach, and throat.

THE ETIOLOGY OF GOITRE. — Dr. Th. Kocher of Berne, Switzerland, first of all determined accurately in what parts of his own canton goitre was common. On comparing the water of these regions with that of goitre-free neighborhoods, says the *London Lancet*, he finds that the one striking difference is that where goitre is abundant the water contains a considerable quantity of organic or organized material, and he concludes that it is this factor which determines the prevalence of goitre in any district. He finds that in certain goitrous parts particular families who have access to special water-supplies in which there is not this quantity of organic matter remain free from goitre, although breathing the same air, living on the same soil, engaging in the same occupations, and eating the same food, as their very goitrous neighbors. On comparing the chemical composition of goitrous and non-goitrous water in the Berne canton, the only other difference he found was that the quantity of sulphate of lime was less in the goitrous; but, as it is well known that goitre is often found in those who drink water richly laden with this salt, this difference cannot explain the great pathological fact. Dr. Tovel has found that the water in goitre-free parts contains a very minute quantity of micro-organisms; and it has further been shown that if goitrous water is injected into rabbits the thyroid gland is very prone to swell, although in dogs the injections have no effect. Kocher's investigations do not certainly completely clear up this difficult subject, but they throw some light upon it, and as such are to be heartily welcomed.

NOTES AND NEWS.

THE corner-stone of the new building of the New York Academy of Medicine, in West 43d Street, near Fifth Avenue, was laid with appropriate ceremonies on the afternoon of Oct. 2.

— The Brussels correspondent of the *London Times* points out that the number of foreign students at the German technical high schools is steadily increasing, especially at Berlin, where last year there were thirteen English students preparing for the professions of mechanical and mining engineers, architects, and chemists.

— The Durban correspondent of the *London Times* telegraphs that the Cape Government has decided to adopt Professor Seeley's proposal for a geological survey under his charge. He believes that other eruptive diamond-bearing tracts like Kimberley exist elsewhere.

— In a paper recently published in the "Transactions of the St. Louis Academy of Science," Nipher has shown that the average rate of rainfall on the State of Missouri during the ten years ending Dec. 31, 1887, was 196,000 cubic feet per second. During the same interval, the average river-discharge of the Mississippi River at St. Louis was 191,000 cubic feet per second.

— Speaking lately at the meeting of the British Association, Sir Lowthian Bell said, "If technical education means, as is sometimes alleged, a system by which, along with scientific instruction, manual dexterity in the use of tools, or a practical knowledge of various manufacturing processes, has to be acquired, I confess I am not sanguine as to the results. Certain I am, that if foreign workmen are more skilful in their trade, which as a rule I doubt, and which in the iron trade I deny, this superiority is not due to scientific training in the manner proposed; for in this they possess, so far as I have seen, no advantage over our own workmen. My objection to the whole system is the impossibility of any thing approaching a general application being practicable. I have not a

word to say against the rudiments of science being taught wherever this is possible. The knowledge so obtained may often give the future workman a more intelligent interest in the employment than he at present possesses; but I think they who expect much good to attend such a thin veneer of chemistry or physics do not take sufficient account of the extent of the knowledge already possessed by more highly educated men, who are now directing the great workshops of the world. It is by extending and enlarging this that substantial aid has to be afforded to industry and science, and not by teaching a mere smattering in our primary or any other schools."

— At St. Petersburg, on Sept. 7, several Pulkova astronomers and geodesists took advantage of the ascent of a balloon belonging to the Technical Society to test the accuracy of barometrical measurements. According to *Nature*, the aeronauts, who reached a height of 1,800 metres, took with them, besides chronometers and various meteorological instruments, a barometer, a barograph, and an aneroid; and they obtained, in addition to the curve of the barograph, the various heights at which the balloon stood during its ascent and descent for twenty-eight different moments. The heights obtained from these measurements will be compared with those found by geodetical angular measurements, which were made at five different places as far distant from one another as Cronstadt, the St. Petersburg University, Kolpino, and Pargolovo; that is, at distances of more than thirty miles between the extreme stations. The geodetical measurements thus secured are now being calculated.

— A botanical garden has been established in the Alps of Valais at an elevation of more than 5,600 feet above the level of the sea. It is situated on a cone-shaped knoll, which is about 200 feet high, and composed of a number of natural terraces, planted with *Pinus cembra* and larch, and faces north, east, and west. On the summit is a plateau facing the south, on which will be a little *châlet*, containing the library and herbarium of the garden. The Association for the Protection of Plants has bought the land, and converted it into an alpine garden for plants from all the alpine regions of the globe. Representatives of the floras of the Himalayas, of the American mountains, of New Zealand, of the Antarctic regions, of the Caucasus, of Siberia, of the Pyrenees, the Alps, the Carpathians, and the Ural, will be separated, and each cultivated in a special division. Naturally, M. H. Correvon was named director of this new trial-garden, in which he had already planted several thousand mountain plants. This garden is at so high an elevation that interesting observations can be made concerning the floras of all the alpine regions of the globe, on the relations of plants with insects, their acclimatization, variability, etc. Already consignments of plants have been sent to M. Correvon; and a German botanist who is travelling in the East, and is continuing the work of Boissier (M. Bornmüller), has promised some interesting specimens. Other parcels are expected from Canada, Greenland, and New Zealand. The *Gardeners' Chronicle*, from which we take these facts, invites all who are in suitable latitudes to send to M. Correvon seeds or bulbs from the northern regions in which they are travelling, for the garden of Bourg St. Pierre, which will necessarily serve later on for the temporary reception of plants from high altitudes which cannot be acclimatized directly with us, but require to be subjected to an intermediate temperature first. In this way, M. Correvon is going to try to acclimatize the celebrated but fragile *Calypto borealis*, which he hopes to introduce into cultivation by accustoming it to this intermediate position.

— The Ceylon papers announce the death of an elephant named Sella, which had served the Public Works Department for over sixty-five years. Originally, we learn from *Nature*, Sella belonged to the last of the Kings of Kandy, Sri Wickrema Raja Singha, and was one of about one hundred elephants which passed to the British Government in 1815, when the Kandyan dynasty was overthrown and the whole island passed under British rule. It was supposed at that time that Sella was fifteen years of age, but this was uncertain. In 1880 it was decided that all the elephants belonging to the Public Works Department should be sold, and Sella fell to a well-known resident of Colombo, Mr. de Soysa. The animal aided in several *keddah* operations for the capture and taming

of wild elephants, but became totally blind about three years ago. He continued, however, to work at the plough until within a short time of his death. After death the tusks were removed, and measured five feet in length. Sella himself was eight feet high.

— Of the various orders of the fungi, the *Uredineæ*, or what are commonly known as the rust parasites, are of present interest to the scientist, in that, in their as yet comparatively unknown life-history, development, and relations to other life, many facts lie still unearthed, and to the agriculturist and horticulturist because the destructive capabilities of these pests are becoming more and more a matter of financial importance. Upon passing through fields of ripening wheat or other of the small grains, one may often be not a little surprised to find that his clothes have become quite thickly besprinkled by a yellowish-brown dust which has fallen from the plants. This is an aggregation of the spores of one of the special forms of what the farmer designates as rust. Whether he regards it as a distinct thing in itself, or as simply a diseased condition of the plant-tissues arising from the evil effects of bad drainage, want of proper light, or what not, none feels to a greater extent than he its destructive effects upon the yield of the crop. The rusts of the agriculturists, however, are but representatives of a great order, embracing more than twelve hundred species, of which it is the province of a paper on "The Heteroecismal Pucciniæ," by Henry L. Bolley of Lafayette, Ind. (published in the *American Microscopical Journal*, vol. x.), to give an outline of the structural development and life-history of a few species.

— Charles R. Williams, in a letter to *The Evening Post*, writes, "Apropos of the frequent discovery in the Far West of fossils of horses with toes, has it ever been recalled that Julius Cæsar had such a horse? Suetonius, in his 'Life of Cæsar,' sixty-first section, says, 'Cæsar made use of a remarkable horse, with feet almost human, and hoofs divided in the manner of toes' (*Utebatur equo insigni, pedibus prope humanis et in modum digitorum ungulis fissis*). The whole passage is interesting. The horse, it appears, was foaled in Cæsar's stud. The soothsayers at once proclaimed that it betokened for its master the dominion of the world, whereupon Cæsar had it reared with the utmost care, and was the first to mount it. Indeed, it would never suffer anybody else upon its back. Later he sat up an image of the horse in front of the Temple of Venus Genetrix. Was not this an instance of what evolutionists call 'reversion'?"

— The vexed question of obtaining some recognition of physical as well as intellectual powers in competitions for the public service was well put before the British Association by Mr. Francis Galton, in his paper, "On the Advisability of Assigning Marks for Bodily Efficiency in the Examinations of Candidates for the Public Service." The curious and hardly accountable disregard of bodily efficiency in those examinations through which youths are selected to fill posts in which exceptional bodily gifts happen to be peculiarly desirable, must, he said, strike the attention of anthropologists with especial force. The reform now asked for is to give additional marks to those youths who, being fit for service, are at the same time exceptionally well fit so far as bodily efficiency is concerned. There has been a vast amount of lax assertion in reference to this matter, some saying that high intellect is often associated with stunted and weakly frame, and others pointing to instances in which high mental and high physical powers have been connected; but it is only very recently that we have secured a firm and sufficiently large basis of facts. These are the various measures of Cambridge students made during the last two or three years, and discussed by Dr. Venn, F.R.S., in an excellent memoir recently published in the *Journal of the Anthropological Institute*. "The number of those who were measured is 1,095, and they were divided into three classes: (1) high-honor men; (2) low-honor men; and (3) poll men, that is to say, those who did not compete for honors, but took an ordinary pass degree. The result was that the physical efficiency of the three classes proved to be almost exactly the same, except that there appeared to be a slight deficiency in eyesight among the high-honor men. Otherwise they were alike throughout, — alike in their average bodily efficiency, and alike in the frequency with which different degrees of bodily efficiency were distributed among them. Therefore the fact that a man had suc-

ceeded in a literary examination does not give the slightest clew to the character of his physical powers; and an opinion that the present literary examinations are indirect tests of bodily efficiency must be considered erroneous. The intellectual differences are usually small between the candidates who are placed, through the present literary examinations, near to the dividing line between success and failure. But their physical differences are, as we have just seen, as great as among an equal number of the other candidates taken at random. It seems, then, to be most reasonable, whenever two candidates are almost on a par intellectually, though one is far superior physically, that the latter should be preferred. This is practically all I propose."

— The Emperor of Brazil has announced by telegram to the Paris Academy of Sciences an observation of globular lightning on Sept. 16.

— In the laboratory of the State Mining Bureau in San Francisco, according to the *Engineering and Mining Journal*, a discovery was made recently which is highly prized. In working a specimen of sulphide or blende ore sent from a mine in Shasta County, Cal., a small piece of native metallic zinc was secured. This is the first piece of the character named ever known to have been secured in this country. Late works on metallurgy note the existence in the mines of Victoria, Australia, of the only native metallic zinc known. The Mining Bureau will endeavor to secure other specimens from Shasta County.

— In the well-known method employed by Regnault for determining the density or specific gravity of air, oxygen, nitrogen, hydrogen, and carbonic acid, we deal primarily with tares, of which the weights to be determined are the differences. The glass balloon which holds the gas is tared by a similar balloon of exactly the same volume, and of nearly equal weight, suspended from the opposite pan of the balance. The small difference of weight required to establish perfect equilibrium is alone measured with standard brass or platinum weights. Whatever may be the form of the subsequent calculation, the primary object is to obtain the tare of the empty balloon when absolutely vacuum. This known, the differences between such tare and the tare of the balloon filled with various aeriform substances, gives the weights of equal volumes of these substances under the temperatures and pressures at which the balloon was filled. The volume of the counterpoise is exactly adjusted to that of the balloon by the aid of a small subsidiary glass bulb; and by sealing up more or less mercury in this bulb it is easy to make the difference of weight such that the standard weights required to complete the equilibrium will measure the differences of tare to be determined, and no more. In the method of Regnault the tare of the empty balloon, or what was equivalent to it, was found by exhausting the balloon with an air-pump and weighing it after measuring the tension of the residual gas while the glass was surrounded by ice. But it has been shown by Aganennone and Lord Rayleigh that the results thus obtained are vitiated to a small extent by the circumstance that when the balloon is exhausted the pressure of the atmosphere determines a slight shrinkage of the external volume, which naturally disturbs the exactness of the compensation between the buoyancy of the air on the balloon and on its counterpoise. Although this shrinkage can be readily measured, as was done by Dr. T. W. Richards under Professor J. P. Cooke's direction, and still more recently by Professor Crafts, who experimented on the balloon used by Regnault, which fortunately has been preserved, it seemed desirable to develop a method by which this correction could be avoided: for, even if the new method should lead to no more accurate results than before obtained, it might serve to confirm the validity of the correction in question, and at least would give additional data towards establishing the value of important physical constants. The new method Professor Cooke has devised for the purpose consists in first taring the balloon when filled with carbonic-acid gas, and then drawing the gas through absorption tubes and determining its weight, as in the well-known method of organic analysis. This weight known, the tare of the empty balloon is obviously the difference between the first tare and the weight in question. The practical problem here presented is, however, far more difficult than that of organic analysis. In the last we expect to determine

the weight of only a few decigrams of carbonic acid within a few tenths of a milligram, while in the problem now before us we must weigh at least nine or ten grams of carbonic acid, not simply to a proportional, but to an equal, degree of accuracy. Professor Cooke only succeeded in securing such accuracy after many trials and a careful study of all the conditions involved; and the primary object in a paper published in the "Proceedings of the American Academy" (vol. xxiv.) is to describe the precautions which are essential to the success of the new experimental method. Incidentally it will appear that the results confirm in a most striking manner the high value of the specific gravity of hydrogen found by Lord Rayleigh, and the low value of the atomic weight of oxygen found by Professor Cooke at the Harvard Chemical Laboratory.

— Mr. A. J. Field, in a letter to the editor of *Knowledge*, on the question whether the female viper swallows its young for their protection, says, "Unfortunately the common adder (or viper) when in captivity is usually a very sullen reptile, and I am afraid that it would give the naturalist but little opportunity for observing its maternal affection, even if a female with young should be obtained without injuriously disturbing or killing the mother. I have kept adders several times, and now have two healthy pairs; but, although I once succeeded in taming a male adder, I have never succeeded in making a female forget that it was a prisoner. Among vipers, the females are certainly more sulky and bad-tempered than the males; so that the question will always remain an open one if we must wait until we see the young swallowed by their mothers in captivity. My illustration showing the adder with its fangs erect (referred to by Pen-y-Pan) is quite correct. Two fangs are erected when the adder prepares to strike, no more. The other teeth are merely in readiness should one or both the fangs be lost. The largest adder I have seen was three feet four inches in length." In reply to this letter, the editor of *Knowledge* writes as follows: "Dr. William Duncan, in a recently published paper on the 'fer-de-lance,' one of the *Crotalide*, or pit vipers, of the West Indian Islands, says that the female fer-de-lance devours her young in very wholesale fashion. This dangerous serpent is very prolific, and sometimes brings forth as many as two hundred young at a birth, seldom less than one hundred. Dr. Duncan says the female fer-de-lance, when about to bring forth her young, 'generally selects a fairly open or cleared space, a mountain footpath being a favorite spot. Along this she crawls slowly, dropping her young one by one on the way. As soon as the last has been brought forth, the faint and hungry mother turns and devours the first of her brood that meets her sight, and continues this unnatural course until satiated with her repast, or she finds no more of her offspring to glut her rapacity. Naturally many of them, three-fourths at least, escape, and these the strongest, — a clear case of the survival of the fittest. This has been observed by several planters in St. Lucia, and has been mentioned to me independently by Mr. E. S. Gordon, Mr. A. R. Maruchau, and Mr. Marius Devaux, and others of the colony.'"

— The opinion expressed by *Engineering* the other day, that the oil-deposits of Burmah really were enormous, in spite of the pessimist report of Dr. Noetling, the paleontologist appointed by the Indian Government to examine the petroleum-fields of Yenang-young, has been justified by events. The Indian press has attacked the report so vigorously in support of Mr. Marvin's views, that Dr. Noetling has been compelled to explain matters in the columns of the *Pioneer*. According to this, since he made his actual survey his opinion has totally changed, and he now agrees that the petroleum-deposits are of the immense character insisted on by the author of the "Coming Oil Age." "Since I wrote my report," states Dr. Noetling, "the oil-bearing strata have been traced over a large area, only a very small part of which has hitherto been exploited, and that in a most unscientific way. I, in my report, calculated, that, under a reasonable system of working, one square mile could produce not less than 1,440,000 litres per diem. This estimate may be a little too high; but admitting only half of the estimated production, say 500,000 litres per diem per square mile of the Burmah oil fields, the production would be something enormous, as the oil-bearing strata are now known to extend, roughly speaking, over an area of not less than 100 square miles, — a fact

which was not known to me at the time I wrote my report." Here there is convincing testimony that the area of the Burmese oil-fields is very large; and the assumption is fair, that, if suitable engineering methods of exploitation be introduced, the industry can be put on a footing that will compete with, and perhaps in course of time even beat, the American oil-trade.

— At the recent meeting of the British Association, a paper by Mr. J. Spiller, on "An Experiment on Color-Blindness," was read. Mr. Spiller has had so much experience in comparing coal-tar colors and testing for color-blindness, that he thought there could be no question as to his own sight being normal. He made himself color-blind on purpose by taking, on Aug. 29, a dose of a grain and a half of santonine, the acting principle of the flowers of *Artemisia santonina*. Within less than five minutes afterwards the white tablecloth appeared of a delicate pale bluish tint, and every thing else as if regarded by spectacles of that color; ultramarine looked normal; violet and pink were good; green turned slate-color. The spectrum was visible, unbroken, but with hardly any variations. There was nothing particular in the green, which appeared fine and normal; and he could not discover the neutral gray band in the green, for which he was particularly searching. Mr. Spiller warned his audience against any repetition of this experiment, which, after all, did not reduce him to ordinary color-blindness, and the results are extremely disagreeable.

— "A Bibliography of Geodesy," by J. Howard Gore, B.S., Ph.D., has been issued as Appendix No. 16 of the report for 1887, of the United States Coast and Geodetic Survey. Although the restricted popular demand for a work peculiarly designed for the uses of the student and scientist rarely induces its author or compiler to forego its preparation, it is nevertheless likely to be a matter of serious consideration in connection with the question of publication by private enterprise. It is especially the case, that, beyond the gratification of his own scientific tastes and the unobtrusive approbation of the worthy few who appreciate the value of appliances which lessen the labor of learning, the compiler of so complete and exhaustive a bibliography of geodesy as that of Professor Gore can have had little to inspire his zeal and sustain his prolonged labor in an undertaking which at the outset involved the thorough exploration, in person, of thirty-four of the principal libraries of America and Europe, the exploration of the minor libraries by proxy, and, in addition, a searching inquiry by correspondence with all the geodesists or mathematicians of both continents. That Professor Gore has not lacked, during the preparation of his work, such inspiration as was derivable from the approbation of the competent, is attested by the generous overtures from various institutions, among them being the International Geodetic Association at Berlin, offering to undertake the publication of his book, — a most gratifying recognition of his fitness for the work, and of its anticipated value. The reason for the preparation of this work was the need of it felt by the compiler. He began in 1885 a history of geodesy, but before proceeding far it was found very difficult at any time to be sure that the literature regarding the operations of a given period had been exhausted. It was at once deemed best to collect titles as well as the works themselves. The excellent library facilities in the various technical departments in Washington emphasized the feasibility of such an undertaking. The number of titles collected for this purpose only, so far exceeded the special lists as given in the various bibliographies of mathematics, that many persons suggested an extension of the original plan, so as to make the compilation useful to others. In response to this proposition, the various libraries in Washington were carefully searched, and during two trips to Europe nearly every library facility there has been exhausted. In order to procure titles of such recent works of living authors as might escape notice, owing to delay in obtaining a place in the library catalogues, a circular letter was sent to every mathematician whose address could be obtained. Each circular had appended to it the titles of all of the known works of the recipient, with a request that omissions be supplied. This alone was the labor of several months, but was fully repaid in the gratifying assurances from many that nothing could be added, as well as in the few additional titles which tend towards making this work complete.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The "Exchange" column is likewise open.

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CONTENTS:

THE BOYNTON RAILWAY.....	259	REPORT OF THE COMMITTEE OF THE NEW YORK STATE MEDICAL SOCIETY ON THE CAUSES AND PREVENTION OF BLINDNESS.....	268
THE RÔLE OF PTOMAINES IN INFEC- TIOUS DISEASES.....	260	BOOK-REVIEWS.	
RUSSIAN LITERATURE.....	262	The New Eldorado.....	270
ELECTRICAL NEWS.		Elementary Lessons in Heat.....	270
New Insulating Material.....	263	Our Cats and all about Them.....	270
Lead-covered Cables.....	263	A Treatise on Ordinary and Partial Differential Equations.....	271
Lightning on War-Vessels.....	263	A Graduated Course of Natural Science.....	271
HEALTH MATTERS.		AMONG THE PUBLISHERS.....	271
The Pathological Bearings of He- redity.....	263	LETTERS TO THE EDITOR.	
Pea-Soup as a Substitute for Beef- Tea.....	264	The Telephone for the Prediction of Thunder-Storms <i>Harvey B. Bashore</i> 273	
Malarial Fever in Eastern Massa- chusetts.....	264	Map of Niagara Falls <i>Joseph F. James</i> 273	
Transplanting of a Chicken's Cor- nea.....	264	INDUSTRIAL NOTES.	
The Sandwich Island Leper Colony.....	264	The Automatic Type-Writer.....	273
The Foods of Different Peoples.....	264	The Offrell Dynamo.....	273
The Dread of Death.....	264	A New Constant-Current Electric Motor.....	274
Cholera in Asiatic Turkey.....	264		
Tobacco and Insanity.....	264		
The Etiology of Goitre.....	265		
NOTES AND NEWS.....			
EDITORIAL.....	268		
The World's Fair.			

THERE IS LITTLE to chronicle this week of the progress in the plan for a world's fair in this city in 1892. The executive committee, composed of members of the various committees who have had the work in charge, and the sinking-fund commissioners, met on Monday and organized. Among the messages received was one from Joseph Pulitzer, subscribing \$50,000 outright, and offering to be one of twenty-five to subscribe \$100,000 each. The work of getting the property-owners within the limits of the proposed site to give the use of their land on any terms can be said to make practically no progress, as was to be expected. Meanwhile the Chicago committee, who want to see the fair in that city, urge in every way the claims of that city. They will have it, that, as Chicago is nearer the centre of population in this country, it will be more accessible for Americans, who will be those most largely represented as visitors and exhibitors. Then, again, the question of site is not a troublesome one for Chicago. It cannot be said that New York has done much yet to secure the fair, and it is certain that Chicago is making a good deal of noise; so that, unless there are some tangible results to show in New York, the popular verdict may soon be in favor of the Western city.

REPORT OF THE COMMITTEE OF THE NEW YORK STATE MEDICAL SOCIETY ON THE CAUSES AND PREVENTION OF BLINDNESS.

TWO years ago a committee was appointed by this society to investigate the question of blindness due to contagious ophthalmia in this State and in the United States, and to recommend means for its prevention. The importance and extent of the subject were so great, that at the meeting one year ago it was only possible to report progress, and ask that more time be given for the work. This was rendered necessary also by the fact that our lamented colleague, Dr. Agnew, was unable to render the valuable assistance upon which we had counted; and only recently has his place on the committee been satisfactorily filled. Even now it seems advisable to give a synopsis of the more important features of the subject, instead of attempting to go into many details which are not only of interest to the ophthalmologist, but also of importance from a sanitary point of view. The reasons for this investigation concerning the increase of blindness will become apparent if a statement is first made of the statistical facts. In presenting these it will be necessary to repeat to a certain extent the statements made in a paper by the chairman of this committee, which was published in the "Transactions of the American Ophthalmological Society" in 1887. As far as we are aware, however, these statistics have not been stated in a similar manner anywhere else. When we compare the report of the United States census of 1870 with the report of 1880, we find the population of the United States in 1870 was 38,558,371, and the number of blind then was 20,320; whereas the population in 1880 was 50,155,783, and the number of blind was 48,929: in other words, while the population of the entire country had increased 30.09 per cent, the number of blind had increased 140.78 per cent.

It is worth while, in passing, to call attention to the distribution of the blind throughout the country, and in doing so to quote the figures in the paper already mentioned. If the United States be divided into three parts, according to latitude,—the first or southern range of States including those which lie below the 35th parallel, the second range between the 35th and 40th, and the third above that,—we find there is a constant increase in the ratio as we pass from the north toward the south. Thus there are, in the northerly range of States, 7.9 blind in each 10,000; in the middle range of States, 9.42 blind in each 10,000; in the southern range of States, 10.81 blind in each 10,000.

There is another classification of the States which is also of some interest. If they be divided according to longitude into three groups, each of which includes about fifteen degrees, we find the proportion of blindness decreases as we go from east to west. According to this division, the first group of States would lie between the Atlantic Ocean and the Mississippi River, extending to about the 15th degree of longitude west from Washington; the second would be from the Mississippi to the Rocky Mountains, or from the 15th to the 30th degree; while the third would include the strip from the Rocky Mountains to the Pacific Ocean, or from the 30th degree of longitude west. Here we find, in the easterly range of States, 10.34 blind to each 10,000; in the middle range of States, 7.90 blind to each 10,000; in the western range of States, 5.68 blind to each 10,000.

So much for the statistics relating to the United States as to the number of blind, their increase throughout the country as a whole, and their distributions in different parts of it.

Let us next consider the statistics which are available relating to New York State alone. The population in New York State in 1870 was 4,382,759, and in 1880 was 5,082,871, being an increase of 15.9 per cent; whereas the number of blind in New York State in 1870 was 2,213, and in 1880 was 4,981, being an increase of 125.07 per cent.

In a similar manner, if we compare the State census of 1875 with the United States census of 1880, we find the population in 1875 was 4,698,958, and in 1880 was 5,082,871, being an increase of 8.1 per cent; while the number of blind in 1870 was 2,256, and in 1880 was 4,981, being an increase of 111.03 per cent: in other words, the official reports show, that, during the ten years preceding 1880, blindness in the State of New York increased 8.2 times as

rapidly as did the population, and during the last five years of that decade it increased 13.7 times as rapidly.

It may be interesting also to glance at the distribution of blind throughout the State of New York. The tenth United States census gives for the first time the number of these unfortunates in the different counties of each State. These statistics are in process of publication; but, as that portion of the report was not complete when this one was being prepared, application was made to the State Board of Charities, where there is deposited a copy of the official returns relating to the blind. The assistant secretary of the board, Mr. James O. Fanning, has kindly furnished the committee with the number of blind in each county, having ascertained that by adding the lists of more than five thousand names on record. The different counties have been arranged in four groups. The first includes those which contain less than .005 of one per cent; the second, those which contain from .005 to .01 of one per cent; the third, those which contain from .01 of one per cent to 5 per cent; the fourth, those which contain more than .0521 of one per cent.

In view of these rather startling assertions in regard to the increase of blindness, it is natural that we should question the correctness of the data which lead to any such conclusions; in other words, to suspect that the apparently rapid increase was due to the difference in the manner in which the statistics were collected in 1870 as compared with 1880. In the compendium of the "Tenth Census" it is stated by Mr. Wines, who has charge of that department, that the plan was essentially the same; but, in order to satisfy ourselves more thoroughly, a letter was addressed to the secretary of the interior, asking for any additional facts in regard to this point, and we were informed that the same outline was followed in one case as in the other, simply a special blank for the blind being filled out in 1880. Of course, these examinations were by no means as accurate as would be desired from the ophthalmological point of view, for the enumerators were often ignorant and careless men; but the fact remains that the errors were probably almost as great in 1870 as in 1880. Moreover, in order to verify the accuracy of some of the figures in the last census, we made application for the returns regarding the city of Buffalo; and while a number of changes of residence were made, and it was difficult to verify the reports in detail, still the information obtained, as far as it went, showed that at least that part of the report was quite as reliable as could be expected.

Let us consider next the causes which tend to make this apparent increase of blindness. In doing so, it is natural that we inquire, first of all, what were the causes which have produced that condition among those who are already blind. To determine this, it seemed advisable to undertake the examination of a considerable number of these unfortunates, and, of course, that could be done most conveniently in asylums, almshouses, where they were collected together. Accordingly a list of questions was prepared, being mainly a copy of that which was used by Hugo Magnus, a specimen of which is here appended; the name of the blind-asylum, location, date of the examination, and name of the examining physician, heading the list. 1. Name of the blind person, residence; name of father or guardian, residence. 2. Sex. 3. Age. 4. Religion. 5. Nationality. 6. For adults, occupation before blindness; for children, occupation of the parents. 7. Color of the hair. 8. Color of the iris, if possible. 9. Degree of blindness: A. Count fingers at $\frac{1}{2}$ of a metre; B. Quantitative perception of light; C. Absolute amaurosis. 10. Cause of the blindness of the right eye. 11. Cause of the blindness of the left eye. 12. Condition of the right eye. 13. Condition of the left eye. 14. Age at which right was lost. 15. Age at which left was lost. 16. Can the blindness be referred to scrofula? 17. Can it be referred to syphilis? 18. Is the blindness the result of any disease of the general system? 19. Are there any other bodily infirmities? (For those who have had small-pox) 20. Was the blindness before vaccination? and 21. Was the vaccination effectual? 22. Did the blindness occur when in a town, or when in the country? 23. Were the parents related to each other? 24. Did the parents have normal vision? 25. Were any of the relatives blind? 26. Were there any other circumstances which might be important in connection with the case?

To the president of each county medical society we then forwarded as many of these blanks as there were blind inmates of his county almshouse, and the request was made that the blanks be filled and returned to the chairman of this committee. Responses were returned in only nineteen instances, although letters with blanks were sent to all. Unfortunately, also, the answers to some of the questions were so indefinite that it was necessary to omit the cases from the classification.

A second set of examinations which the committee have to acknowledge was made by Dr. W. H. Bates of New York, acting under the supervision of Dr. H. D. Noyes. This list includes one hundred and sixty-eight cases seen at the New York State Institution for the Blind in New York. The third list contains the results of an examination of one hundred and twenty-eight inmates of the New York State Institution for the Blind at Batavia. These examinations were made by the chairman, assisted by Dr. Elmer Starr of Buffalo.

In spite of this plan of inquiry, it is difficult to determine exactly some of the causes of the blindness, even when the greatest care was exercised; but it was evident from even the most casual examination that a very large percentage of the cases were due to some form of contagious disease of the eye. It must be admitted that in the case of blind-asylums this representation, however truthful in itself, has a tendency to exaggerate the importance of the contagious disease of the eye as a cause of blindness. We do not find at such an institution those who have become blind by accident to adult life, or by those diseases which are more common in old age. A table of percentages is given by Magnus in his admirable work on blindness, in which he brought together the results of examinations by different investigators, which covered a total of 2,528 cases of blindness. In this table it may be seen at a glance how very great is the influence of those diseases which are distinctly of a contagious kind as compared with any other, over 20 per cent of those of all ages being due to contagion. In the "Annual Report of the Manhattan Eye and Ear Infirmary for the Year 1886" is given a summary of 48,509 cases, of which it was shown that 26 per cent were due to conjunctival diseases, and 25.5 per cent to corneal diseases; but one of those who made this report, when speaking of them, mentions "over 50 per cent as being communicable, or closely related to communicable diseases." In summing up, therefore, this portion of the question as to what are the causes which have produced blindness, it is fair, we think, to reply that contagion exercises by far the most important influence.

There is another aspect of this part of the subject which it is necessary to mention: we have reference to the influence which immigration has upon the increase and spread of contagious diseases of the eye, directly and indirectly. A considerable number of facts might be presented to illustrate this phase of the subject. We need only select as an example the influence exerted by one class of immigrants in relation to spreading one disease of the eye. It is generally conceded that trachoma is essentially contagious, and also is of frequent occurrence among the lower class of the Irish population. Now, the report of the Treasury Department for 1886 shows that from 1871 to 1880 there were nearly half a million of Irish immigrants in this country, — more exactly, 444,589, — and during these years the Irish formed 15.1 per cent of all the immigrants who arrived in the United States. It should be borne in mind that by far the greater part of these immigrants — at least four-fifths of them — land at Castle Garden. In order, therefore, to ascertain what care was exercised in isolating any such contagious cases which might enter there, a letter was addressed to the physician in charge of the State Emigrant Refuge and Hospital at Ward's Island, New York, inquiring as to this point; and his replies, although frankly given, were by no means such as to impress one with the care which the authorities exercise as to the disposition of such cases.

Few persons appreciate how great is the cost to the community of the maintenance of a number of persons in their midst who are not only non-producers, but who must also be fed and clothed. It is possible to make an estimate of the annual cost to the State for the maintenance of the blind. Supposing they were all provided for in an economical manner, such as can be done in large institu-

tions: it is fair to estimate the cost of keeping each one at \$2 per week, or \$104 per year; to which should be added, for clothing, \$28 per year, or a total cost of \$132. These are the figures given in the report of the Perkins Institution, a Massachusetts asylum for the blind; in October, 1874. It must be remembered, however, that these individuals are not producers: they do not earn what they otherwise would; and this amount must be added to the cost. Taking the lowest estimate of a man's wages at \$1.20 for each working day, supposing that not one among them all could become a skilled artisan, and counting the wages of the women at only 40 cents a working day, we find there is a total yearly loss to the community, cost and wages for each man, of \$404, and for each woman of \$256. This, at the very minimum estimate, amounted in New York, in 1880, to \$1,682,136, and over \$25,000,000 in 1888 for the entire United States.

If these statements are of as much importance as they would appear, it behooves us at least to inquire what steps can be taken for lessening the increase of blindness. In a paper like this it is possible only to refer briefly to points which are of primary importance, without attempting detail in any respect. At present, however, if we were to suggest a plan, it would be about as follows:—

First, To popularize with the profession and laity the necessity of some care as to the proper cleansing of the eyes of infants immediately after birth; to impress the importance of this matter upon nurses, hospital attendants, and others; and, if possible, to teach them to apply to every infant's eyes a suitable solution of nitrate of silver, which need never be stronger than two per cent, and of maximum quality.

Second, Enactments should be encouraged similar to that recently passed by the New York State Legislature in regard to the proper isolation and quarantining of children with suspicious diseases of the eyes in all residential schools and in large institutions in which children are brought together. Moreover, similar rules, with proper modifications, should be adopted in prisons, reformatories, and other institutions for adults. Especially does this hold good concerning soldiers in barracks, and sailors on shipboard.

Third, By educating the public. The laity should be cautioned as to the contagious character not only of the so-called granular lids, but especially of those severe forms of inflammation of the eye which result from inoculating it with gonorrhoeal matter. This might be accomplished by posting notices in proper places, officially signed by the Board of Health or other proper officers. Other proper notices posted in stone-quarries, machine-shops, etc., would tend to lessen the proportion of accidents to eyes, so frequent in these places.

Fourth, That steps be taken to prevent the introduction into this country, by immigration, of cases of contagious diseases of the eye.

Fifth, That renewed efforts be made by the profession to collect data relating to bacteria affecting the eye, especially to the action of the gonococcus, the so-called trachoma coccus of Michel, and other forms of either the normal or diseased conjunctiva.

In submitting this report the committee is impressed with the fact that any such presentation of statistics and recommendations is entirely inadequate to give a proper idea of the importance of the subject. In order to condense the statement as much as possible, it has been necessary to omit certain phases of the question entirely. The distribution of blindness in different portions of the State; the relation of certain causes which produce it to altitude, to density of population, and other factors,—have been entirely omitted for the sake of brevity. The bacteriological questions which it involves have been hardly referred to, although considerable data have been accumulated relating to the causes of the disease here, by a personal examination of the same causes as they exist in Egypt, in Finland, and in other countries where blindness is of frequent occurrence. It is hoped, however, that these few facts, though imperfectly presented, may arouse some slight interest in the subject, and, in doing so, tend to lessen the number of those most unfortunate and most pitiable of human beings, the blind.

LUCIEN HOWE
E. V. STODDARD } Committee.
HENRY D. NOYES }

BOOK-REVIEWS.

The New Eldorado; A Summer Journey to Alaska. By MATURIN M. BALLOU. New York, Houghton, Mifflin, & Co. 12°. \$1.50.

MR. BALLOU, who has travelled extensively in various parts of the globe, here gives us an account of a recent trip across this continent and up the coast of southern Alaska. He is a close and cultivated observer, though not exactly of the scientific order, and his book is intended rather for popular than for learned readers. He tells his story well, except that he is sometimes too anxious to be picturesque, and occasionally falls into rhetorical exclamations that might better have been omitted. On his journey across the continent he tarried nowhere any length of time save in the Yellowstone National Park, where he spent ten days, and to which he devotes several chapters. The scenery that abounds there, however, is not easily described, and his book contains no pictures nor maps to supplement the work of the pen. Arrived on the Pacific coast, Mr. Ballou's party embarked on a steamer and sailed up the coast of Alaska, passing for the most part between the islands and the mainland. The northern parts of the territory were not visited, though the author gives some account of them taken from other authorities. Alaska has generally been supposed unfit for agricultural purposes; but Mr. Ballou assures us that all the southern part will grow any crops that will thrive on the Atlantic coast north of Chesapeake Bay. Still the agricultural resources of the region as a whole are admitted to be small; but its fisheries are well known as of great value, its timber abundant, and its mines of gold, iron, and coal, of special importance. All these resources are described at length by our author, as is also the scenery of the region he passed through. The native inhabitants, however, hardly correspond with the natural features of the country. Mr. Ballou says what good he can of them; but in laziness, filthiness, cruelty, and superstition they are like all barbarians the world over. The Eskimo live in the extreme north, while the natives of the region Mr. Ballou visited are similar to the Indian tribes of our older Territories, though superior in intelligence. Since the government has established a few schools among them, they have shown great eagerness to learn, and the increase of such schools is strongly advocated. Mr. Ballou complains that Congress has not done its duty by Alaska, and gives good reasons for this view, and he also thinks that the scientists have been backward in the work of exploration. On his part, he believes that the future of Alaska is bright with promise, and readers of his book will, to some extent at least, share his views.

Elementary Lessons in Heat. By S. E. TILLMAN. Philadelphia, Lippincott. 8°. \$1.80.

THE author is professor of chemistry at the United States Military Academy, and prepared these lessons for use at West Point in a short course on heat. The character of the matter presented was determined to some extent by the peculiarities of the course of study at the academy; but the main point sought was to give the information most likely to be needed, and to give it without overloading with details of apparatus and methods of investigation. After a number of chapters on the elementary principles of heat, there follow several on thermodynamics,—not treated mathematically,—and the influences of heat and cold on meteorological phenomena.

Our Cats and all about Them. By HARRISON WEIR. Boston and New York, Houghton, Mifflin, & Co. 12°. \$2.

MR. WEIR is president of the National Cat Club of England; but before he was that, and before the club existed, he was the originator of the cat-show at the Crystal Palace, held in the summer of 1871.

What they talk of at the Cat Club we may believe to be the "points" of their pets, and the latest trick or show of wisdom in door-opening or wandering home of these same pets. This is what the book tells of. It is a gossip book, full of stories of the doings of cats, sprinkled with descriptions of the innumerable kinds, with an account of their diseases, and ending with several chapters on trained cats, and cats that have learned to fish.

The author confesses to having been won over to a love for cats

from having been their hater, and writes this book that others may see the cat in all its possibilities as a useful, attractive, and affectionate domestic animal.

At the present time, when the power cats possess of finding their way home over supposed to be unknown roads is receiving some discussion, it is interesting to note that at a race of this kind held near Liege, Belgium, in 1860, the winner was a blind cat.

But it is not alone of cats as cats that our author tells us: he gives us also a glossary of terms of which the word "cat" forms a part. In fact, "Our Cats and all about Them" is a title well borne out by the contents, so far as such information as the ordinary reader is likely to seek is concerned.

A Treatise on Ordinary and Partial Differential Equations.
By WILLIAM WOOLSEY JOHNSON. New York, Wiley. 8°. \$3.50.

THIS treatise on differential equations is in continuation of the series of mathematical text-books, by the same author, of which have already appeared the differential and integral calculus. Professor Johnson is professor of mathematics at the United States Naval Academy at Annapolis, and it may be that some will trace in the book methods which are said to be characteristic of the United States Army and Navy mathematics; but it must be said that the plan pursued is likely to lead to a clearer understanding by the student. The object is to give a knowledge of the subject, so far as it is likely to have practical application; and in this it is safe to say that Professor Johnson has succeeded.

A Graduated Course of Natural Science, Experimental and Theoretical, for Schools and Colleges. Part I. By BENJAMIN LOEWY. London and New York, Macmillan. 12°. 60 cents.

THOSE who are trying to introduce sane methods of science-teaching into our schools, will find in Mr. Loewy's little book much that is suggestive and of value. Mr. Loewy was at one time the science master in the recently discontinued International College

just out of London, and has had twenty years of experience in teaching physics and chemistry to large classes, both in the lecture-room and in the laboratory. In this first part of his series he confines himself to the physical phenomena which arise on account of the mutual attraction of particles of matter, but he has limited himself to those interactions of matter that his experience shows him to be really intelligible to young beginners. This sketch of the author's purpose may be misleading, as the following summation of some of the chapter-heads will show: "Pressure in Liquids," "Filtration," "Cause of Winds," "Hard and Soft Water," "Action of Animals and Plants on Air," etc.

AMONG THE PUBLISHERS.

THE Longmans will publish shortly two volumes of American short stories, — "Gerald French's Friends," tales of California Irishmen, by George H. Jessop; and "A Family Tree and Other Stories," by Brander Matthews.

— The October number (No. 43) of the Riverside Literature Series (published quarterly during the school year 1889-90 at 15 cents a number, by Houghton, Mifflin, & Co., Boston) contains the "Story of Ulysses among the Phæacians," from William Cullen Bryant's "Translation of Homer's Odyssey." This selection, which has been described by one of our most famous Greek scholars as the finest and at the same time simplest bit of imaginative writing in all Greek literature, is a complete story in itself. It tells of Ulysses' discovery by Nausicaä, the daughter of King Alcinoüs, his reception by the king, the festivals given in his honor, his song of the Trojan Horse and the Fall of Troy, and his departure for his home in Ithaca, and gives a most excellent picture of the life, manners, and customs of the ancient Greeks. This number of the Riverside Literature Series will be found of especial value for use in schools. It is rarely possible to make a selection from a great poem like the "Odyssey" at once so complete in itself, so fascinating, and so instructive, as is this "Story of the Adventures of Ulysses among the Phæacians."

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Fellow of University College, London, and Professor of Queen's College, London, Assisted by eminent contributors.

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— D. Appleton & Co. have ready "A Text-Book of Animal Physiology," with introductory chapters on general biology and a full treatment of reproduction, by Dr. Wesley Mills. They have nearly ready "Lessons on Hygiene," a revision of "How We Live," by James Johnnot and Eugene Bouton, prepared under the direction of Mrs. Mary H. Hunt, superintendent of the Educational Department of the Woman's Christian Temperance Union.

— Charles Scribner's Sons have ready the second volume of the "Cyclopædia of Music and Musicians," which contains, besides many text portraits of musicians and singers and facsimile scores and autographs, full-page etched portraits of Gounod, Handel, Haydn, Lasso, Liszt, Lully, Mendelssohn, Meyerbeer, Mozart, Paine, Palestrina, and Purcell; and a new book by Donald G. Mitchell (Ik Marvel) entitled "English Lands, Letters, and Kings, from Celt to Tudor."

— Harper & Brothers published on Oct. 11 a volume on the "Constitutional History of the United States," by George Ticknor Curtis. It is a revised edition of Mr. Curtis's earlier work, which, though published thirty years ago, remains to-day the established authority on the history of the formation and adoption of the Constitution. Many years ago Silas Wright, then United States senator from New York, requested George Bancroft to write a life of Martin Van Buren, and furnished a complete collection of papers and letters as materials for the work. From these and other sources Mr. Bancroft compiled a biography which Van Buren, when he saw the manuscript, pronounced to be authentic and true as a record of facts relating to himself. Party feeling ran high at the time, and Mr. Bancroft deemed it best to postpone the publication of the work until the character and career of Van Buren could be judged without prejudice. Nearly coincidentally with the author's eighty-ninth birthday, Messrs. Harper & Brothers published this biography, which is entitled "Martin Van Buren to the End of his Public Career." In his preface Mr. Bancroft says, "In my recent revision of the original manuscript, I have made no change that could affect Van Buren's approval of it as thoroughly correct."

— Messrs. John Wiley & Sons have just issued "A Chart Relative to the Composition, Digestibility, and Nutritive Value of Food," prepared by Professor Henry A. Mott, Ph.D., LL.D. The subjects of the chart are arranged under the following heads: "Relative Value of Foods;" "Digestibility of Foods;" "Most Easily Digested Substances;" "Daily Proportions of Carbon and Nitrogen in the Food of Different Ages per Pound Weight of the Body;" "Substances absorbed and discharged during Twenty-four Hours;" "Amount of Digestive Fluids secreted Daily, and the Proportion of their Chief Constituents;" "A Dinner that will digest within Two Hours;" "Uses of Food in the Body;" "Way in which Nutrients are used in the Body, and supply it with Strength;" "Nitrogen and Carbon required Daily to support Life;" "Alimentary Substances in a Dry State required Daily for the Support of an Ordinary Workingman of Average Height and Weight;" "Standards for Daily Dietsaries;" "Standard for Ordinary Man doing Moderate Muscular Work;" "Warmth and Strength derived from Various Articles of Food and Drink;" "Composition of Various Meats;" "Composition of Meat Extracts;" "Composition of Fish and Shell-Fish;" "Composition of Vegetables;" "Composition of Farinaceous Foods;" "Composition of a Hen's Egg;" "Composition of Cocoa;" "Composition of Coffee;" "Composition of Tea;" "Composition of Various Kinds of Cheese;" "Analyses of Cheese;" "Analysis of Milk;" "Analysis of the Products of the Dairy;" "Analysis of Condensed Milk;" "Analysis of American Wines;" "Approximate Analysis of a Man;" "Fruits arranged in the Order of their Contents of Free Acid expressed as Hydrate of Malic Acid;" "Fruits arranged in the Order of their Contents of Sugar;" "Fruits arranged according to the Proportion between Acid, Sugar, Pectin, Gum, etc.;" "Working Power of the Human Body;" "Thermotic Power and Mechanical Energy of Ten Grains of the Material in its Normal Condition when completely burned in Oxygen and when oxidized into Carbonic Acid;" "Water and Urea in the Animal Body;" "Ingredients and Food-Materials;" "Quantity of Nitrogen and Carbon in 100 parts of Various Alimentary Articles." The price of the chart, mounted on rollers, is \$1.25.

— Ticknor & Co. have just published a limited edition of the late Carl Pfeiffer's work, "American Mansions and Cottages," containing one hundred folio plates in a portfolio. They have also just ready a one-volume edition of Charles Wickes's "Illustrations of Spires and Towers of the Mediæval Churches of England."

— Edward Atkinson has contributed an article on "The Art of Cooking," which will open the November *Popular Science Monthly*. In it he points out what enormous quantities of food and fuel are wasted in ordinary cooking, and describes the "cooker" and "oven" invented by him, which need but a wonderfully small quantity of oil or gas, and cannot spoil the food. Col. Garrick Mallery's address before the American Association for the Advancement of Science, on "Israelite and Indian," will be published in the same number. It shows the remarkable similarity between the mortuary customs and religious beliefs and practices of the two peoples, but Col. Mallery draws a conclusion from this parallel unfavorable to the suggested descent of the Indians from the "lost tribes." "The Decadence of Farming," as shown by the number of farms for sale and the prevalence of farm mortgages, will be explained by Mr. Joel Benton in this number (the writer maintaining that our modes of taxation bear more heavily on the farmers than on any other class); and there will be a copiously illustrated article on "Sensitive Flames and Sound-Shadows," by Professor W. LeConte Stevens, embodying some very curious instances in which sound has been found to behave like light.

— Casey's "Treatise on Spherical Trigonometry," published by Longmans, Green, & Co., London and New York, is intended as a sequel to the author's "Treatise on Plane Trigonometry." The book contains much that is new; the author, as is customary now, having culled rich material from the latest mathematical papers. There is a large number of examples furnished, which are believed to cover the ground completely. Professor Casey is professor of higher mathematics and mathematical physics at the Catholic University of Ireland.

— The Forest and Stream Publishing Company announce for publication "Pawnee Hero Stories and Folk-Tales," by George Bird Grinnell. The book is said to present a faithful delineation of the Indian's character and his daily life.

— Mr. George Curzon, M.P., who made a detailed examination of the Transcaspian country last fall, has written an account of his travels; and his "Russia in Central Asia in 1889" and the "Anglo-Persian Question" will be published soon by Longmans, Green, & Co., both in London and New York. It will contain maps from the latest investigations, some forty illustrations, and a bibliography.

— S. C. Griggs & Co., Chicago, have just issued a translation from the Danish, by Professor Julius C. Olson of the University of Wisconsin, of Peter Lauridsen's work entitled "Vitus Bering, the Discoverer of Bering Strait." They will publish soon a new edition, from new plates, of Dr. J. R. Boise's "First Lessons in Greek," revised, with the advice and approval of the author, by Professor G. Pettengill of Ann Arbor High School.

— Messrs. Ginn & Co. announce for publication "Russell's Chromatic Chart," by E. P. Russell, director of Conservatory of Music, and teacher of music in the State Normal School, Oneonta, N.Y. This chart is designed to teach music-students the habit of thinking the tone as well as reading it, so that the mind may perceive the tone before the voice executes it. It is of great help in teaching the intervals by quick transitions from one key to another. It is of the greatest value in the study and execution of the chromatic scale. The teacher will observe that the chart will, if carefully and intelligently used, help the articulation and enunciation to a remarkable degree. It is believed that the chart is a practical help, of which every wide-awake and progressive teacher will desire to make constant use. The size of the chart is 42 inches by 55 inches. They have also just published the "Common School Song Reader," by W. S. Tilden, teacher of music in the State Normal School, Framingham, Mass., and will issue during the autumn and winter of 1889, "Open, Sesame!" edited by Mrs. B. W. Bellamy and Mrs. M. W. Goodwin, — a collection of prose and verse, comprising more than a thousand selections, carefully edited, and arranged for com-

mitting to memory. It is in no sense an elocutionist's manual, the editors having made the first test of each selection, "Is it worth learning?" and the second, "Is it adapted to recitation?" The book is representative of English literature, and also comprises many translations from foreign sources. Its various departments contain many of the familiar classics, and also many extracts from late literature never before included in such a collection. It is arranged in three volumes, each complete in itself, and specially adapted to the age for which it is intended. Volume I. is designed for children from four to ten years old; Volume II., for those from ten to fourteen; and Volume III., for the oldest students. The purpose of the book is to train the memory, to educate the literary taste, and to supply the student with the long-needed standard collection of poetry and prose for recitation.

— "The Batrachia of North America," by E. D. Cope, issued as Bulletin No. 34 of the National Museum, embraces the results of a study of the characters of the species, with their variations, which has been rendered effective by the full collection contained in the National Museum, and which this work thus illustrates. Besides this descriptive part, there are presented the results of a thorough study of the osteology of the class, based on the material contained in various museums of the United States and Europe. These results are expressed largely in systematic form, in the belief that descriptive zoölogy will never be complete until the structure is exhausted in furnishing definitions. Wherever practicable, reference is made to the relations between the extinct and living forms.

LETTERS TO THE EDITOR.

The Telephone for the Prediction of Thunder-Storms.

IN 1886 the writer had an experimental telephone line on the Yale campus which proved to be of some value in the prediction of

one phase of the weather. As is well known, the approach of an electrical storm produces sounds in the telephone something like the "sound of a distant rocket, or the quenching of a drop of melted metal in water."

One afternoon shortly after the erection of my line, on a seemingly perfectly clear day, I heard the sounds in the telephone. Although at the time there was no sign of an approaching storm, two hours later the clear weather had vanished, and a severe storm swept over the city.

On another occasion, when an excursion had been planned, as the weather was cloudy and rather doubtful, the telephone was consulted, but gave no evidence of electrical disturbance; and the afternoon passed "fair weather."

In several like instances I made use of the instrument with very satisfactory results. Since then I have had no opportunity for continuing my observations, but I think that similar use of the telephone might be of value to individuals or to local communities.

HARVEY B. BASHORE.

West Fairview, Penn., Oct. 14.

Map of Niagara Falls.

ON the 88th sheet of the new "Stieler's Hand Atlas," No. 6 of the United States, is a small map of Niagara Falls, which contains a curious misprint. The course of the river is well shown, colored red on the Canadian and green on the United States side. The horseshoe fall is represented, but the American fall is obliterated. The coloration for the bank extends all round Goat Island; which, however, instead of being an island, is a peninsula. In other words, there is no American fall represented on the map except in name.

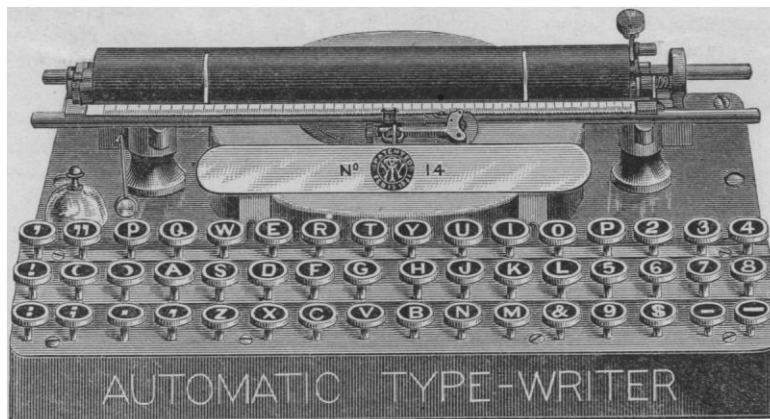
JOSEPH F. JAMES.

Washington, D.C., Oct. 10.

INDUSTRIAL NOTES.

The Automatic Type-Writer.

ALL are familiar with the ordinary styles of type-writer on the market, and some have asked if there could not be made a type-writer which should cost less and be more portable by being smaller in size and weight. Several attempts have been made to meet this want, and this week we have an opportunity of describing the "Automatic," which it is claimed serves the purpose well.



In size the "Automatic" is 11½ inches long, 8¼ wide, and 4 high. Its weight is 10 pounds, and with its case, only 12¼.

The key-board of 48 keys has been designed with a view to furnishing all the characters in common use. The type and type-bars are so arranged that the type is inked by spring contact with an ink-pad against which it rests when in repose, and the type-bars are so guided in their motion as to give very accurate alignment. No ribbon intervenes between the type and paper, the impression being thus the clearer. It is claimed for the "Automatic," that, as the paper-carriage is light, as the space through which the type must move is small, and as its return motion is accelerated by a spring, the speed of writing is much increased.

By an ingenious device the spacing is made to suit the letter.

Thus, *I* occupies less space than *H*, and *H* less again than *M*.

There are other interesting features to the machine, but we have said enough to show that those interested should examine the merits of the "Automatic."

The Offrell Dynamo.

ALTHOUGH the construction of dynamos and motors has reached such a state of perfection, as regards efficiency and workmanship,

that any improvement in this direction is not likely to be made, yet many of the electric machines in the market to day are far from being samples of either of the above qualities; and, to be sure, if we consider them from the point of simplicity and economical construction, there is a big margin for improvement.

Setting out with the object in view of designing a dynamo, that, with minimum expenditure of material, should give maximum output, and at the same time the cost of its manufacture be a minimum, Mr. Olof Offrell, electrical engineer, has designed and built such a dynamo.

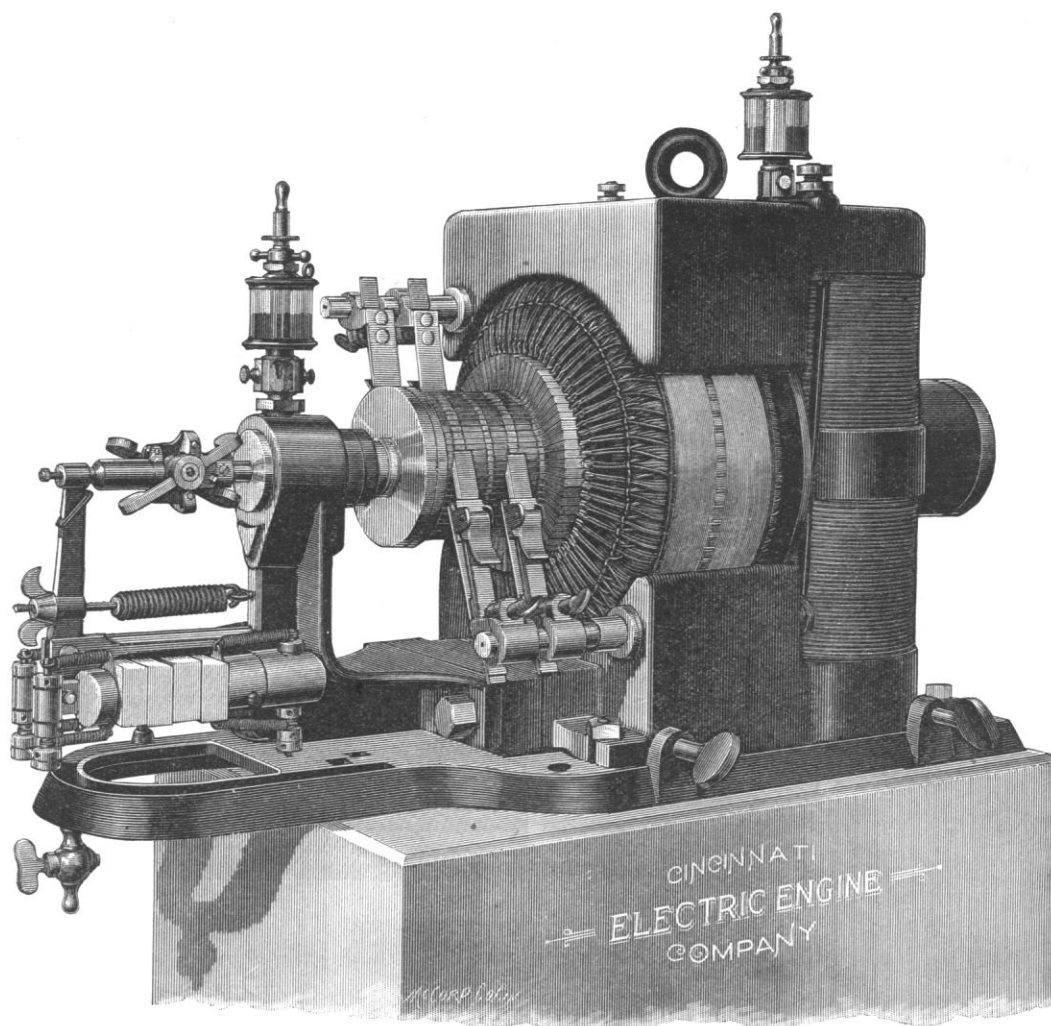
To gain this purpose, only the very best material is used; also advantage is taken of the latest development in dynamo-building. The field-magnet cores are of the very best wrought iron, the pole-

pieces being the softest possible cast iron. The magnets and the pole-pieces form a solid frame, being held together by nuts on the tapped ends of the magnets. The armature, which is of the Gramme type, is supported by brackets of brass bolted to the pole-pieces, and the shaft runs in phosphor-bronze bearings fitted to the brackets. The armature is made of annealed wrought-iron wire supported by a three-armed spider of brass.

The brush arrangement is of improved construction, original with the designer, and enables the tension of the brushes to be adjusted without disturbing the setting of the same, and without exposing the attendant to shocks from the machine. This is effected by an insulated thumb-screw, — aside from the thumb-screw that holds the brushes, — which clamps the brush-holders to the brush-pin. The rocker-arm is also movable. The cables from the brushes are carried to a board on top of the machine, on which are

two horse-power, and, being very compact, occupies a floor-space of only ten by nineteen inches, with a height of twelve inches.

The armature is of the Gramme ring type, and the pulley end of the shaft has its bearing in the neutral part of the field-magnet. The shaft is of English tool steel of the best quality, the bearings are ground true on dead centres, and the armature is so attached as to practically constitute a portion of it, avoiding all danger of loosening, — a point of importance in this class of machinery. Ball bearings are used, admitting of self-alignment. They are made of phosphor-bronze, hand-reamed, and of considerable length, to give an even bearing surface and prevent all tendency to heat. The commutator sections are of drop-forged copper, hard, and of almost pure metal. The commutator is attached to the armature in a novel manner, and can be renewed without disturbing the armature wires.



CINCINNATI ELECTRIC ENGINE COMPANY'S MOTOR.

placed the terminals; also a switch for short-circuiting the field-coils, in case it is desired to "paralyze" the machine while running. Thus the switch and terminals are always in sight, and can be attended to at once, if necessary.

A remarkable feature of this dynamo is that it requires exceedingly small floor-space for its capacity, — a feature of great value when the space is limited, as on board of ships, etc. The floor-space required for a twelve-light dynamo is only twenty-four by twenty-four inches.

A New Constant-Current Electric Motor.

THE electric motor shown in the accompanying illustration is one of a series manufactured and placed on the market by the Electric Engine Company of Cincinnati. It is intended to run on a constant-current or arc-light circuit, has a maximum capacity of

The armature is accurately adjusted to a running balance, and provided with means for forced ventilation. The ordinary rocker-arm supporting the brush-holder has been dispensed with, thus rendering the important parts more readily accessible.

The governor, the construction of which is shown in the figure, maintains the speed constant under all variations of load from zero to the full designed load of the machine, and is remarkably simple, having but one wearing point. It regulates solely by variation of pressure, practically eliminating motion and wear: hence it has great durability and sensitiveness.

For constant potential circuits, this company manufactures motors of similar design, but differing in detail. As they regulate automatically, they do not require governors. These are made for standard potentials of 110, 220, and 550 volts, though they may be made for any specified voltage.